US Antidumping Petitions and Revealed Comparative Advantage of Shrimp Exporting Countries*

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Abstract

The paper explores the trade competitiveness of seven major shrimp exporting countries, namely Vietnam, China, Thailand, Ecuador, India, Indonesia and Mexico, to the USA. Specifically, we investigate whether the United States (US) antidumping petitions impact upon the bilateral revealed comparative advantage (RCA) indexes for each of the seven shrimp exporting countries with the USA. Monthly data from January 2003 to December 2014 and the panel data model are used to examine the determinants of the RCA for the shrimp exporting countries. The empirical results show the shrimp exporting countries have superior competitiveness against the shrimp market in the USA. Moreover, the RCA indexes are significantly negatively influenced by shrimp prices, and are positively affected by US income per capita. However, the EMS (Early Mortality Syndrome) shrimp disease, domestic US shrimp quantity, exchange rate, and US antidumping laws are found to have no significant impacts on the RCA indexes. In terms of policy implications, the USA should try to reduce production costs of shrimp in the US market instead of imposing antidumping petitions, and the shrimp exporting countries should maintain their comparative advantage and diversify into new markets.

Keywords: Shrimp, antidumping, revealed comparative advantage, panel data model.
JEL: C23, F13, P45, Q17.

1. Introduction

International trade stimulates economic growth, which promotes growth and national income. Globalization encourages the development of science and technology, creates more jobs, and increases living standards. Free trade plays an important role in worldwide economic development.

For developing countries, in particular, the agricultural sector contributes significantly to economic growth. Exporting agricultural products to world markets is a traditional way of improving national income and development, as well as reducing poverty in developing countries. Aquaculture is also increasingly important for many countries, and seafood products contribute significantly to international trade in both quantity and quality.

Aquaculture has expanded the seafood industry, increasing production from 2.5 million tons in 1970 to more than 35 million tons in 2000, with most of the increase occurring in developing nations (Aksoy et al., 2005). Developing countries account for more than 50 percent of the global fish product trade by value, and for around 50 percent of globe aquatic products traded. Among many species of aquatic products, shrimp has been the largest single commodity in terms of value, accounting for about 15 percent of the total value of internationally traded fishery products in 2010 (Deutsch et al., 2011), and for 17% of global seafood in 2006 (Asche et al., 2012). Asia and some Latin America countries are the main regions that provide shrimp to international markets.

The USA has a high demand for shrimp products, so that shrimp suppliers from both foreign countries and US firms have become highly competitive. Imported shrimp has frequently been the subject of antidumping investigations (that is, imports sold at less than fair value) and countervailing duty investigations (that is, subsidized imports) in the USA (see, for example, Kassam and Malhotra, 2006; Wang and Reed, 2014).

Even though Free Trade Agreements have eliminated many obstacles in international trade, a government might impose antidumping tariffs on imports from selected countries if it determines that: (1) the imports are being sold at less than a fair price (or dumped) in domestic markets; and (2) the pricing of these imports is harming, or threatening to harm, domestic producers of the same goods (Klitgaard and Schiele, 1998). While lower tariffs have been applied over the past three decades on account of the proliferation of bilateral and multilateral trade agreements, the use of antidumping and countervailing duties have been increasing as alternative patterns of trade prevention. To state the obvious, US antidumping measures imposed on shrimp products would be a major obstacle for the international shrimp trade (Wang and Reed, 2015).

The US antidumping duties are more likely to be imposed on sectors in which the USA has low revealed comparative advantage (RCA) (Bown et al., 2005). The RCA of the same products will vary across different countries because of a number of factors associated with natural resources and economic structures. As an example, Shen (2010) argues that US antidumping actions against China have focused mainly on products that have strong RCA in the US market. Despite the imposition of US antidumping actions, 35 kinds of Chinese products have managed to maintain their strong RCA in the US market in most years.

In terms of the shrimp trade in the US market, which is a primary focus of the paper, China, Vietnam, Thailand, Ecuador, India, Indonesia and Mexico are the major suppliers. Shrimp products from these seven countries have frequently being subject to the imposition of US antidumping duties.

Overall, RCA is a useful tool to evaluate the status of comparative advantage among countries. The strength of RCA can be affected by trade policy, such as antidumping policies, among others. However, whether a certain product or certain industry sector can maintain their comparative advantage can differ for different products. In this paper, RCA is used to evaluate the degree of comparative advantage in the US market and other leading shrimp suppliers. There is a substantive literature regarding the demand for a variety of seafood species, but studies on shrimp consumed in the USA are relatively few compared with other seafood (Wang and Reed, 2015).

For a better understanding of the possible effects of US antidumping policies on the shrimp trade, it is important to explore the bilateral comparative advantage of the seven main shrimp exporting countries with the USA, and whether the US antidumping policy affects the bilateral comparative advantage of the exporting countries. It is also important for policy implementation to determine whether the shrimp exporting countries can maintain or lose their comparative advantage when they are subject to US antidumping policies.

In order to investigate the two issues mentioned above, we will calculate the bilateral RCA for each shrimp exporting country in the US market, and investigate the determinants of the RCA of the shrimp exporting countries. The paper will determine the extent to which the US antidumping policies affect the RCA of the seven major shrimp exporters to the USA.

The remainder of the paper is organized as given below. Section 2 provides an overview of the US shrimp market. The literature on both antidumping policies and bilateral comparative advantage (RCA) are reviewed in Section 3. The Bilateral Revealed Comparative Advantage is calculated, the empirical model is presented, and the data sources are discussed, in Section 4. This is followed by the empirical results in Section 5. Some concluding remarks are given in Section 6.

2. US Shrimp Market

Since the 2000s, shrimp has been a favourite seafood in the USA. High demand for shrimp has led the USA to become one of the largest shrimp importers worldwide. Shrimp has several positive attributes, such as being low in fat, a good source of protein, containing important vitamins and minerals, and being easy to digest. These reasons for the high quality characteristics of shrimp products make consumers demand its availability. In 2007, US customers consumed 4.1 pounds of shrimp per capita, compared with 2.5 pounds in 1994, which is a substantial increase in 13 years (Market Indicator Report, 2010).

Asche et al. (2012) comment that the consumption of shrimp in the USA reflects the global surge in shrimp farming activities. In 2004, shrimp was ranked the first in per capita seafood consumption at 4.2 pounds, which was almost one pound per capita greater than the second ranked seafood category, namely tuna at 3.3 pounds per capita. In 2010, shrimp consumption still remained high at 4.0 pounds per capita, in comparison with 2.7 pounds per capita of tuna, with the difference between the two increasing to 1.3 pounds per capita. The majority of the consumption was supplied from imported farm- raised shrimp, as the USA has become the

world's largest shrimp import market. Currently, the supply of shrimp into the US market is from foreign suppliers. In 1980, domestic shrimp in the USA had a 43% market share, but that share had declined drastically to 12% by 2001.

The developing countries in Asia and Latin America are the major areas supplying shrimp into the world market, in general, and into the US market, in particular. These shrimp exporting countries include China, Thailand, Vietnam, India, Indonesia, Ecuador, and Mexico. The rapid increase of farmed shrimp production, coupled with US domestic wild-caught fisheries, has created trade competitiveness in the USA (Asche et al., 2012). In order to protect the US domestic shrimp activities, trade restrictions on shrimp against these major shrimp suppliers was enacted in 2004 after the domestic fishing industry filed anti-dumping complaints against several shrimp exporting countries (Keithly and Poudel, 2008).

However, according to Reed and Royales (2014), demand for shrimp in the USA has increased over the years, and shrimp is currently the largest imported seafood species, accounting for 29 percent of seafood imports by dollar value. In 2013, consumers and businesses found themselves paying higher prices for shrimp, with lower availability of supply in supermarkets and restaurants (Reed and Royales, 2014).

The US shrimp market is highly competitive among shrimp suppliers, both from several main foreign exporters and US domestic supply. Cheaper overseas imports have displaced domestic supplies, which the USDA valued at about $US 600 million in 2014. Harvests in the Gulf of Mexico, which account for most of the US-sourced shrimp, slumped to 18,316 tons through July 2015, down 35 percent from five years ago, according to the National Marine Fisheries Service (Mulvany, 2015).

In the US shrimp market, shrimp imports dominate domestic supply. Both shrimp prices and shrimp supply volume fluctuate considerably. Shrimp supply is dependent on the state of shrimp-farming production, which is strongly affected by shrimp disease. In particular, early mortality syndrome (hereafter, EMS) has occurred in South-East Asian shrimp cultivation. Consequently, EMS has dramatically curtailed shrimp exports to the USA, which also results in high US import prices (Reed and Royales, 2014).

The nature of shrimp farming makes shrimp highly susceptible to disease. Eighty percent of world shrimp production occurs in small-scale, open-air systems, in which water flows in and out between ponds. One of the leading factors behind the higher import prices is the EMS epidemic that has affected shrimp supplies in South-East Asia. Specifically, a bacterial disease known as acute hepatopancreatic necrosis syndrome (hereafter AHPNS) causes EMS. AHPNS kills juvenile shrimp by destroying their hepatopancreas, an organ crucial to the animal's digestion. The disease spreads quickly as shrimp eat and infect other shrimp, and can destroy a pond's entire shrimp population within a matter of months.

In addition, the syndrome's onset occurs before the shrimp are mature enough to reproduce. First appearing in China in 2009, AHPNS spread to Vietnam in 2010, Malaysia in 2011, and Thailand, the world's largest shrimp exporter, in 2012. AHPNS has affected shrimp supplies, particularly Pacific white shrimp and black tiger shrimp, in the latter three countries (Reed and Royales, 2014). The EMS caused the shrimp industry losses that exceeded $1 billion in 2013 (Worldfishing and Aquaculture, 2014).

Moreover, the US domestic shrimp supply has been negatively affected by the continuous rise in fuel prices, which has had a direct impact on operational costs (FAO, 2008). Owing to these reasons, shrimp supply and shrimp imports prices have been strongly influenced by shrimp disease and production cost, particularly fuel prices.

Processed shrimp imports were also higher in the US market, which indicates a positive market trend for value-added shrimp (FAO, 2009). It is interesting to note that in terms of volume, the third supplier was Ecuador, with 15,700 tons, while in terms of value, the third exporter to the US was Vietnam (US$ 95 million). Asian nations accounted for almost 80% of the total supply of peeled frozen and for greater than 95% of other frozen preparations and breaded frozen to the US market, while frozen shell-on shrimp had a higher share of Latin American supplies.

Furthermore, US shrimp imports are influenced by the exchange rate. For instance, in 2011, Asian suppliers to the US suffered from the effects of the weakening US dollar against Asian currencies, in particular, the Thai Baht and Indonesian Rupiah (FAO, 2011). This caused a decline in shrimp exports from these shrimp exporters.

Regarding the US demand side, demand was strong in both restaurants and in supermarkets, driven primarily by improved disposable income and employment opportunities. The middle to higher income consumers provide the primary consumer market for shrimp in the USA (FAO, 2014).

In general, the US shrimp market is one of the largest markets worldwide. The US demand for shrimp is relatively high, with the main shrimp suppliers for the US market coming from foreign developing countries in Asia and Latin America. Shrimp demand in the US market depends on

many factors, including income and seasonal influences. Furthermore, shrimp price imports into the US market fluctuate considerably, and is caused by shrimp disease, shrimp production of foreign suppliers, import tariffs, and seasonality, among others.

3. Antidumping and RCA with the US Shrimp Trade

Baughman (2004) argued that antidumping duties imposed on shrimp suppliers would lead to an increase in the US prices of both domestic and imported shrimp. Consequently, the price increases would be passed on to shrimp-consuming industries, including food processors, grocery stores, and restaurants, and eventually to US consumers. Nguyen (2010) examined the effects of US laws and policy on catfish prices and trade flows. Both price and demand for domestic catfish increased after the US ITC imposed an antidumping tariff on catfish imports from Vietnam. The empirical results showed that the tariff was ineffective, and antidumping policies were evaluated as a weak tool to protect the US catfish industry. Moreover, US consumers have borne the burden from the consequences of higher domestic catfish prices.

According to Debaere (2010), the US antidumping case against shrimp exporters in the US market is the largest case since the imposition of steel tariffs. Estimates for the shrimp market provide evidence that large countries can affect world prices and/or domestic prices through their trade policies. However, competition has also led to trade disputes. Seafood exporting countries (mainly developing countries) complained that importing countries (mainly developed countries) used antidumping tariffs, stringent market standards or other barriers to protect inefficient domestic industries. On the other hand, importing countries accused seafood exporters of gaining an unfair competitive advantage through ignoring environmental and social costs, and asked for a level playing field (Cai et al., 2010).

Shen (2011) examined the correlation between RCA and US antidumping duties against 97 Chinese products that has been affected by US antidumping petitions. It was argued that the US antidumping action against China focused mainly on Chinese products with high RCA in the US market. Of the 97 Chinese products, there were 62 products with high RCA relative to US products, accounting for 64% of the total products. This indicated that the US antidumping petitions focused on Chinese products that possessed high RCA compared with related US products.

Furthermore, of the 62 products mentioned above, 35 products still maintained high RCA, while 27 lost their advantage in the US market. Shen (2011) argued that, "although US [antidumping] actions against Chinese products cannot fundamentally cripple the strong RCA of China's exports (cannot cripple all 62 products that have high RCA above as 35 products still maintain high RCA), it has caused negative destruction effects to some exports (make 27 products lost their RCA) to the US."

However, Shen (2011) explored the impact of the RCA on US antidumping duties, not US antidumping on the RCA. In addition, Bown and McCulloch (2005) found that US industries that filed antidumping petition counselling had a lower RCA index than those which did not file antidumping petitions. Therefore, US industries which have lost RCA, or are losing RCA, are more likely to file antidumping petitions against China[1].

[1] The initialization of an antidumping petition occurs when the Department of Commerce determines that a petition has satisfied all necessary requirements to initiate an investigation, in which case the Department of Commerce will publish a Notice of Initiation in the Federal Register. The Notice of Initiation will lay out a general history of the proceeding, including dates of official filings, as well as the scope of the investigation, explain how the Department of Commerce made a determination of industry support, and details how the petitioners calculated normal value and US price. This is referred to as question 15 in the site given above.

Overall, the RCA is a useful tool for evaluating the status of comparative advantage for different countries, though it can be affected by government policy, such as antidumping petitions. As discussed in Section 1, whether a certain product or certain industry sector can maintain their comparative advantage can differ for different products. Therefore, in this paper, we use RCA to evaluate the degree of comparative advantage in the US market and leading international shrimp suppliers.

He et al. (2013) use the gravity model of international trade to investigate the determinants of shrimp imports from China, Vietnam, Thailand and Indonesia to the USA Their empirical results show that US GDP per capita has a positive impact on shrimp volume imports from the four suppliers to the USA. In particular, the winter and fall seasons are the times of increasing shrimp imports into the USA. Furthermore, antidumping tariff law has been effective in curtailing shrimp imports from the four exporters. The empirical results also confirmed that the weakening dollar against the currencies of the four shrimp suppliers slowed down shrimp exports.

Wang and Reed (2014) investigated the demand elasticity of imported shrimp in the USA by shrimp exporting countries. They also tested how countervailing duties imposed by the USA affected source-specific shrimp imports. The results indicated that the US demand for imported shrimp is inelastic. Moreover, even with the countervailing duties imposed on shrimp exporting countries, US total shrimp imports were predicted to increase.

In addition, Wang and Reed (2014) investigated whether the final decision of US antidumping duties in 2004 on imported shrimp distorted a named country's (that is, a country that imposes

antidumping laws on shrimp suppliers) exports to third markets. They found that the named countries' (that is, USA) trade flows (from countries such as China, Ecuador, India, Thailand and Vietnam) had been reoriented (or diverted) to other markets during the period of US antidumping duties imposed against their shrimp exports. This result is in line with previous studies on trade deflection (Bown and Crowley, 2007).

Wang and Reed (2015) analyzed the effect of US shrimp antidumping duty on import diversion. The empirical results indicated that antidumping duties shifted the shrimp trade from named countries, as discussed above) to non-named countries (that is, countries that do not implement antidumping laws on shrimp suppliers). They concluded that the effect of trade protection through antidumping for US shrimp was a weak trade tool.

A number of researchers have investigated the impacts of US antidumping policy on the shrimp trade. Most studies have focused on US shrimp demand, rising US shrimp prices, and shrimp trade diversion or deflection. However, few papers have studied the correlations between the bilateral RCA of shrimp exporting countries with shrimp importing countries and the associated antidumping laws. To the best of our knowledge, the paper is the first empirical analysis based on a panel regression model to investigate the impact of US antidumping petitions on shrimp exporting countries.

4. Empirical Model

4.1. Bilateral Revealed Comparative Advantage

In order to capture the bilateral competitiveness of each of the seven exporting countries with the USA as the importing country, we compute the revealed comparative advantage indexes

(RCA indexes). Following Utkulu and Seymen (2004), the version of RCA from Balassa (1965) can be derived as given in equation (1):

$$RCA_i = (X_i - M_i) / (X_i + M_i) \quad (1)$$

where X_i and M_i represent exports and imports, respectively, and $i = 1,\ldots,7$ represents the shrimp exporting country.

The RCA index in equation (1) represents the bilateral competitiveness between each of the seven shrimp exporters with respect to the US importers within the US shrimp market only. The range of the RCA index is from -1 (that is, $X_i = 0$ and revealed comparative disadvantage) to 1 (that is, $M_i = 0$ and revealed comparative advantage). It is crucial that RCA calculations are based on observed trade data, for which there are likely influences of government trade policies in the associated markets, such as tariffs, quotas or subsidies (see further details in Utkulu and Seymen, 2004).

4.2 Panel data model

In order to capture how US antidumping policies affect RCA for each of the seven shrimp exporters (China, Vietnam, Ecuador, Thailand, India, Indonesia and Mexico) with the US importers in the US shrimp market, we use the panel data model to analysis the determinants of RCA. The specific panel data model is given as follows:

$$y_{it=} \alpha + X'_{it}\beta + u_{it}\ ,\ i = 1,\ldots, 7\ ;\ t = 1,\ldots, T\ , \quad (2)$$

where β is a k-dimensional vector, *i* denotes each of the seven shrimp exporting countries, *t* denotes time for *T* observations in the panel, $u_{it} = \mu_i + v_{it}$, μ_i denotes the unobservable individual-specific effect, and v_{it} denotes the random disturbance (for further details, see Baltagi, 1995).

Before conducting the panel data regression, it is necessary to conduct the Hausman test for model selection. The Hausman test is typically applied to tests for fixed versus random effects models under the null hypothesis (H_0) that the random effects estimator is consistent and BLUE (that is, the best linear unbiased estimator), against the alternative hypothesis (H_1) that the random effects estimator is inconsistent (see, for example, Maddala and Lahiri, 2010).

The Hausman test statistic is given as:

$m_1 = \hat{q}_1'[var(\hat{q}_1)]^{-1}\hat{q}_1$, where $\hat{q}_1 = \hat{\beta}_{GLS} - \hat{\beta}_{within}$,

where GLS denotes Generalised Least Squares and *within* is the null hypothesis estimator. Under H_0, m_1 follows the asymptotic χ_k^2 distribution, where *k* denotes the dimension of the slope vector β (see Baltagi, 1995 for further details).

The dependent variable is RCA_{it}, as given in equation (1), which is defined as the revealed comparative advantage of the exporting country *i* to the USA. Data are available for the period from January 2003 to December 2014. The data sources and definitions of the explanatory variables are summarized in Table 1, while the descriptive statistics of the variables by country are given in Table 2.

The numbers of US antidumping actions against the seven exporting countries are separated into two parts, namely the preliminary investigation and the final antidumping decision, for which the two phases are captured by two dummy variables, $PRELIM_{it}$ and $FINAL_{it}$ respectively. The data sources and definitions of the explanatory variables are presented in Table 3, and the detailed information for the EMS variable is presented in Table 4.

5. Empirical Results

5.1 Bilateral Revealed Comparative Advantage for Seven Shrimp Exporting Countries

In order to capture the comparative advantage of product-exporting countries in terms of international trade, a number of studies have used the revealed comparative advantage (RCA) index. RCA indexes can be calculated to measure the magnitude of comparative advantage of either a sectoral industry, such as agriculture, aquaculture, or textiles, or a specific commodity. Furthermore, RCA indexes can be used to evaluate either the comparative advantage among producing countries in the framework of a world market, or bilateral comparative advantage country by country.

In the situation of the competitiveness of international trade within the US shrimp market, it is useful to explore the bilateral comparative advantage among the seven shrimp exporting countries with the USA.

The bilateral RCA of Vietnam, China, Thailand, Ecuador, India and Indonesia are relatively close to 1 for a long period in the sample, specifically from 2003 to 2014. China's RCA indexes have minor fluctuations over the period 2011 to 2014. This situation might be explained by the rising domestic demand for shrimp products and the severe impact of the EMS shrimp disease,

which first occurred in China in 2009. The bilateral RCA indexes for Vietnam, Thailand, Ecuador, India and Indonesia have been stable over a long period from 2003 to 2014. Therefore, the estimated bilateral RCA implies a strong tendency for these countries to export shrimp to the US market.

In other words, these countries are relatively adept at producing shrimp in comparison with the USA. For Mexico, its RCA indexes are slightly lower as compared with the other six countries, but they have always exceeded 0.4. The bilateral RCA indexes of Mexico have increased over the period 2003 to 2014, and were remarkably close to 1 during the period 2011 to 2014. This situation might be explained by the increasing shrimp production in Mexico. In addition, the US demand for shrimp has been recovering in accordance with the US economic recovery in recent years.

Overall, the empirical results of the bilateral RCA indexes indicate that most of the seven shrimp supplying countries have significant comparative advantage over US shrimp producers. On the other hand, as a highly developed country, the USA tends to exploit its resources, focusing mainly on the high technology industry rather than shrimp farming and related aquaculture. Moreover, the labour costs in highly developed countries such as the USA is typically much higher than in developing countries. Therefore, shrimp farming or shrimp capturing activities in the USA are usually at a much greater cost compared with the seven shrimp exporting countries. Consequently, the US shrimp producing activities are relatively ineffective.

According to Shen (2011), RCA is one of the leading factors that have led to the US antidumping petitions. The USA intends to use the antidumping policy as a tool to protect the

domestic shrimp industry, which is less competitive in terms of production costs. Bown and McCulloch (2005) argue that US industries that are filing antidumping petitions have a lower RCA index than those which do are not filing such petitions. Therefore, as discussed previously, US industries which have lost RCA, or are losing RCA, are more likely to file antidumping petitions against foreign suppliers (Shen, 2011).

In the following section, we investigate if US antidumping policy is a useful and efficient policy to affect the bilateral RCA of the seven major shrimp exporting countries. The estimated results of the panel data model will be presented in Section 5.2.

5.2 Effects of Anti-dumping on RCA

In order to investigate how the US antidumping actions and other important factors affect bilateral RCA, this paper uses the R software (version 3.2.4) for the empirical application. Three approaches for the panel data are used, including pooled Ordinary Least Squares (OLS), the fixed effects model, and the random effects model. The correlations between the explanatory variable and panel data estimates are shown in Table 6.

Regarding model selection, we follow two steps. First, the F test for individual effects is used to test whether the pooled OLS or the fixed effects model is preferred statistically. As the F test value of 28.251 is significant at the 1% level, the fixed effects model is preferable. Second, the Hausman test is used to test whether the pooled random effects or fixed effects model is preferred statistically. The null hypothesis is that the coefficients estimated by the efficient random effects estimator are the same as those estimated by the consistent fixed effects estimator (see Baltagi, 1995).

The Hausman test results indicate that the null hypothesis cannot be rejected at the 10% level, which means there is no significant correlation between the individual effects and the explanatory variables. Therefore, the random panel data model estimates will be discussed in the remainder of the paper.

The estimated results of the random effects model are presented in Table 6. The signs of the estimated coefficients are generally as expected. The estimation results show that the two policy dummy variables, *PRELIM* and *FINAL*, are not statistically significant. This implies that the preliminary investigation and the US antidumping final decisions have not significantly affected the bilateral RCA of the seven major shrimp exporting countries.

Wang and Reed (2015) investigated whether named exporters systematically altered their shrimp trade patterns after their products have had US antidumping duties imposed. Their analysis showed that the shrimp trade flows were reoriented (or redirected) to other markets, including the European Union and Japan, when US antidumping duties were levied against their shrimp products in the US market. In addition, as discussed previously, this empirical finding is in line with previous studies on trade deflection and redirection (Bown and Crowley, 2007; Grant and Anders, 2011).

The bilateral RCA indexes of seven shrimp exporting countries and the US have not been significantly affected by US antidumping, while the shrimp trade flows from these seven countries have been reoriented to the EU and Japan markets. This suggests that the capacity of the domestic US shrimp supply is relatively small compared with the foreign suppliers.

On the other hand, the US shrimp industry is not efficient in terms of cost production. Therefore, the bilateral RCA indexes have not been affected by the US antidumping policy. The seven exporting countries have maintained their comparative RCA indexes, regardless of the US antidumping petitions. In addition, the shrimp supply into the US market depends strongly on foreign supplies mainly from developing countries in Asia and Latin America.

The coefficient of the real price of shrimp products from the exporting country to the USA (*PRICE*) variable is -0.014, and is statistically significant at the 1% level. As the shrimp imported price increases by 1 $US/kilo leads the bilateral RCA indexes to decrease by 0.015 unit, this means the bilateral RCA is highly negative and significant to the shrimp exported price from the seven exported countries to the US market. This empirical finding is in accordance with the results of Kiet et al. (2006), who investigated the RCA of the shrimp industry in Vietnam, and concluded that the competitive advantage of shrimp is strongly sensitive to the export price in Vietnam.

The coefficient of shrimp disease (*EMS*) variable is not statistically significantly, although the coefficient of EMS has a negative sign and shows a negative correlation between RCA and EMS. The empirical results show that the severe shrimp disease has no statistical significance on bilateral RCA.

However, EMS is the most severe disease in the shrimp industry, with the first outbreak in shrimp farms in China in 2009, which spread rapidly to other shrimp producing and exporting countries in Asia. The disease reduced shrimp production substantially, and also increased shrimp prices significantly. Even though the lower shrimp production and higher shrimp prices

were caused, at least partly, by EMS, the shrimp supply into the USA has been maintained, which led to the stable RCA of the shrimp exporting countries.

Domestic US shrimp production (*USSHRIMP*) shows no significant impact on the bilateral RCA indexes, with a coefficient value of -0.014. On the contrary, the US income per capita (*USINCOME*) has a positive effect on the bilateral RCA, as the coefficient value of 0.086 is statistically significant at the 5% level. Therefore, US income per capita has a positive correlation with the bilateral RCA, and suggests that when national income increases by 10 million dollars, this leads to an increase of 0.0913 in the bilateral RCA indexes. In other words, the demand for imports shrimp in the USA will increase with increasing national income.

There is no statistical impact for the exchange rates of the currency of the shrimp exporting countries against the US dollar on bilateral RCA (*EXCH*). However, the coefficient of *EXCH* is only 0.0006, which shows that the exchange rate has virtually no impact on the bilateral RCA.

The seasonal dummy variables, *Q1, Q2, Q3*, are used to capture the seasonality on the bilateral RCA. Seasonality indirectly affects the bilateral RCA through the shrimp volume imports into the USA, which is relevant to shrimp production and shrimp demand in the US market. The coefficients of the second and third quarters are -0.059 and -0.058, respectively, which suggest that the bilateral RCA indexes during the second and third quarters are significantly lower than in the remaining two quarters. These estimated seasonal effects are consistent with the FAO (2014), whereby shrimp is likely to join turkey during the traditional Thanksgiving in November, as well as in the Christmas and New Year celebrations. These are indicators for the positive impacts in quarters one and four.

6. Concluding Remarks

Based on the empirical results, the antidumping duty would seem to be an ineffective tool to protect the US shrimp industry. On the other hand, developing countries remain as major suppliers in terms of shrimp products to the US market, regardless of the US antidumping petitions.

This is one of only a few studies in which antidumping policy imposed on the shrimp commodity has been investigated using an econometric model. The empirical estimates obtained in the paper suggest that the shrimp demand in the USA is substantially met by shrimp suppliers from developing countries as the domestic US shrimp supply is insubstantial compared with the US demand for shrimp.

The findings of the paper contribute empirical evidence and support for several studies which suggest that the US antidumping policy is a weak trade tool and harmful to US consumers and foreign suppliers.

The paper has studied only one aspect of the possible impacts of US antidumping on the RCA index. US antidumping actions might have other impacts which should be studied in detail in future research, including: (1) US antidumping petitions might affect household incomes from exporting shrimp countries, which are primarily developing countries; and (2) the policy might also burden US consumers for shrimp owing to the higher prices of shrimp imports.

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Figure 1

Bilateral Comparative Advantage Indexes of Seven Shrimp Exporting Countries Compared with the US Shrimp Sector

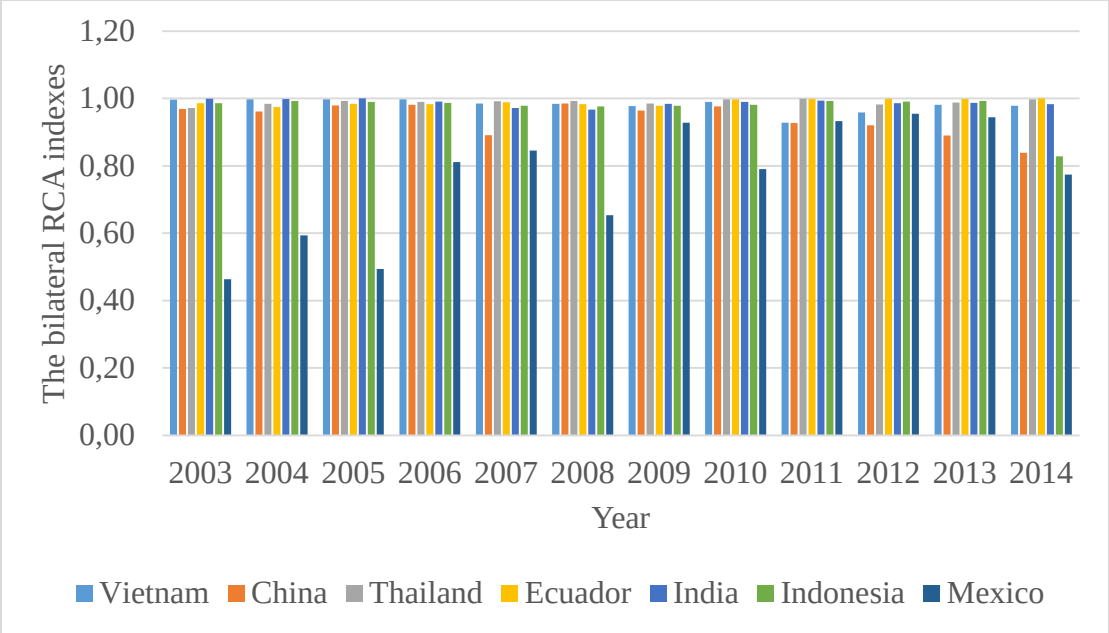

Table 1

Variables and Data Sources

Variable	Definition	Sources
$PRICE_{it}$	Real price of shrimp products from exporting country i to USA recorded at US customs (real price = nominal price/import and export commodity index in USA); unit: US dollar per kilo.	National Marine Fisheries Services
$PRELIM_{it}$	$PRELIM_{it} = 1$ if the exporting country is in the period of preliminary investigation, otherwise = 0.	International Trade Administration, USA
$FINAL_{it}$	$FINAL_{it} = 1$ if the exporting country is in the period of implementation of anti-dumping duty, otherwise = 0.	Department of Commerce
EMS_{it}	For the period of the most destroying disease on shrimp named EMS (Early Mortality Syndrome)	NACA, FAO (2011); Lightner et al. (2012), Mooney (2012), Flegel (2012), Leaño and Mohan (2012)
$USSHRIMP_{it}$	Quantity of domestic shrimp in USA; unit: millions kilos.	National Marine Fisheries Services
$USINCOME_{it}$	Income per capita in USA; unit: 10,000 US$ per month	Bureau of Economic Analysis of the USA
$EXCH_{it}$	Exchange rate toward each exporting countries.	OANDA Services
$Q1_{it}$	$Q1_{it} = 1$ in the first quarter, otherwise $Q1_{it} = 0$	
$Q2_{it}$	$Q2_{it} = 1$ in the second quarter, otherwise $Q2_{it} = 0$	
$Q3_{it}$	$Q3_{it} = 1$ in the third quarter, otherwise $Q3_{it} = 0$	

Table 2

Descriptive Statistics for 6 Shrimp Exporting Countries

Vietnam	**Unit**	**Min**	**Mean**	**Max**	**S.D.**
RCA	*ratio*	0.761	0.980	1.000	0.036
PRICE	*$US/kilo*	6.416	9.119	12.853	1.385
EXCH	*1,000 VND/$US*	14.820	17.739	21.150	2.382
China	**Unit**	**Min**	**Mean**	**Max**	**S.D.**
RCA	*ratio*	0.580	0.940	1.000	0.086
PRICE	*$US/kilo*	3.436	4.682	6.703	0.731
EXCH	*CNY/$US*	6.098	7.158	8.268	0.816
Thailand	**Unit**	**Min**	**Mean**	**Max**	**S.D.**
RCA	*ratio*	0.874	0.989	1.000	0.019
PRICE	*$US/kilo*	4.500	6.486	9.793	1.246
EXCH	*THB/$US*	28.967	34.533	42.863	4.150
Ecuador	**Unit**	**Min**	**Mean**	**Max**	**S.D.**
RCA	*ratio*	0.830	0.989	1.000	0.0191
PRICE	*$US/kilo*	3.886	5.297	8.053	0.928
EXCH	*1,000 ECS/$US*	24.053	24.127	24.263	0.052
India	**Unit**	**Min**	**Mean**	**Max**	**S.D.**
RCA	*ratio*	0.844	0.987	1.000	0.023
PRICE	*$US/kilo*	5.737	7.864	9.982	1.041
EXCH	*INR/$US*	39.356	48.297	63.778	6.186
Indonesia	**Unit**	**Min**	**Mean**	**Max**	**S.D.**
RCA	*ratio*	0.877	0.986	1.000	0.012
PRICE	*$US/kilo*	5.005	6.881	10.364	1.139
EXCH	*1,00 IDR/$US*	82.059	95.713	124.12	10.001
Mexico	**Unit**	**Min**	**Mean**	**Max**	**S.D.**
RCA	*ratio*	-0.590	0.778	0.996	0.341
PRICE	*$US/kilo*	4.959	8.855	16.049	2.378
EXCH	*MXN /$US*	10.099	11.967	14.682	1.144
USSHRIMP	*million kilos*	0.104	0.893	2.029	0.518
USINCOME	*$US*	0.927	1.221	1.501	0.157

Table 3

EMS – Shrimp Disease (Early Mortality Syndrome)

Country	EMS – dummy variable
Vietnam	EMS = 1 after January 2010, otherwise EMS =0
China	EMS = 1 after January 2009, otherwise EMS = 0
Thailand	EMS = 1 after January 2012, otherwise EMS = 0
Ecuador	EMS = 0 any time
India	EMS = 0 any time
Indonesia	EMS = 0 any time
Mexico	EMS = 1 after January 2013, otherwise EMS =0

Table 4

US Preliminary Investigation and Final Decisions for Seven Exporting Countries

COUNTRY	**Preliminary Investigation**
Vietnam	PRELIM = 1 in 1~9/2003 and 1~12/2011, otherwise 0
China	PRELIM = 1 in 1~9/2003 and 1~12/2011, otherwise 0
Thailand	PRELIM = 1 in 1~9/2003 and 1~12/2011, otherwise 0
Ecuador	PRELIM = 1 in 1~12/2003 and 1~12/2011, otherwise 0
India	PRELIM = 1 in 1~9/2003 and 4/2011~3/2011, otherwise 0
Indonesia	PRELIM = 1 within 1 ~ 12/2011, otherwise 0
Mexico	PRELIM = 0
COUNTRY	**Final Decisions**
Vietnam	FINAL = 1 in 12/2004~12/2009 and 8/2013~12/2014, otherwise 0
China	FINAL = 1 in 12/2004~12/2009 and 8/2013~12/2014, otherwise 0
Thailand	FINAL = 1 in 12/2004~12/2009, otherwise 0
Ecuador	FINAL = 1 in 12/2004~8/2007 and 8/2013~12/2014, otherwise 0
India	FINAL = 1 in 12/2004~12/2009 and 8/2013~12/2014, otherwise 0
Indonesia	FINAL = 0
Mexico	FINAL = 0

Table 5
Correlations for Explanatory Variables

Variables	*PRICE*	*USSHRIMP*	*USINCOME*	*EXCH*
PRICE	1	-0.243	-0.350	-0.225
USSHRIMP	-0.243	1	0.013	-0.029
USINCOME	-0.350	0.013	1	0.680
EXCH	-0.225	-0.0289	0.680	1

Table 6

Effects of Antidumping on RCA

Variable	Pooled Estimation	Fixed Effect	Random Effect
$PRICE_{it}$	-0.015*** (0.002)	-0.013*** (0.003)	-0.014*** (0.003)
$PRELIM_{it}$	0.031** (0.012)	-0.013 (0.014)	0.010 (0.014)
$FINAL_{it}$	0.057*** (0.010)	-0.009 (0.012)	-0.006 (0.011)
EMS_{it}	0.024 (0.015)	-0.002 (0.016)	0.0003 (0.016)
$USSHRIMP_{it}$	-0.015 (0.013)	-0.012 (0.012)	-0.012 (0.012)
$USINCOME_{it}$	0.035 (0.034)	0.094*** (0.035)	0.086** (0.034)
$EXCH_{it}$	0.001*** (0.0001)	0.0002 (0.001)	0.0006 (0.0007)
$Q1_{it}$	-0.019 (0.015)	-0.017 (0.014)	-0.017 (0.014)
$Q2_{it}$	-0.065*** (0.015)	-0.058*** (0.012)	-0.059*** (0.012)
$Q3_{it}$	-0.031** (0.014)	-0.030** (0.013)	-0.058*** (0.012)
Constant	0.977*** (0.047)	0.969*** (0.053)	0.965*** (0.058)
Adj. R-Squared	0.141	0.262	0.057
Log-Likeihood F-statistic Prob (F-statistic)	549.383 17.583 0.000	628.963 23.386 0.000	- 7.130 0.000
Model selection test			
F test (P-value)	28.251*** (0.000)		-
Hausman Test χ^2 Prob. > χ^2	-	0.6434 (0.9928)	
Observation	1008	1008	1008

Note: *** denotes significance at 1%, ** 5%, * 10%.